

6.1 Applications Word Problems

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Application 13. **NEWSPAPERS** Due to increased production costs, the Daily News must increase its subscription rate. According to a recent survey, the number of subscriptions will decrease by about 1250 for each 25¢ increase in the subscription rate. What weekly subscription rate will maximize the newspaper's income from subscriptions?



$$\begin{aligned}
 I &= (\# \text{subsci.}) (\text{nw rate}) \\
 I &= (50,000 - 1250x)(7.50 + .25x) \\
 I &= -312.5x^2 + 3125x + 375,000 \\
 x &= \frac{-b}{2a} = \frac{-3125}{2(-312.5)} \\
 x &= 5 \\
 \text{nw price} &= 7.50 + 1.25 = \$8.75
 \end{aligned}$$

ARCHITECTURE For Exercises 44 and 45, use the following information.

The shape of each arch supporting the Exchange House can be modeled by $h(x) = -0.025x^2 + 2x$, where $h(x)$ represents the height of the arch and x represents the horizontal distance from one end of the base in meters.

44. Write the equation of the axis of symmetry, and find the coordinates of the vertex of the graph of $h(x)$.

45. According to this model, what is the maximum height of the arch?

$$\begin{aligned}
 V &= \frac{-b}{2a} = \frac{-2}{2(-.025)} \\
 a &= -.025 \\
 b &= 2 \\
 c &= 0 \\
 44. \quad x &= 40 \\
 V(40, 40) \\
 45. \quad \text{max height} &= 40\text{m}
 \end{aligned}$$

PHYSICS For Exercises 46 and 47, use the following information.

An object is fired straight up from the top of a 200-foot tower at a velocity of 80 feet per second. The height $h(t)$ of the object t seconds after firing is given by $h(t) = -16t^2 + 80t + 200$.

46. Find the maximum height reached by the object and the time that the height is reached.

47. Interpret the meaning of the y -intercept in the context of this problem.

$$\begin{aligned}
 V &= \frac{-80}{2(-16)} \\
 V(2.5, 300) \\
 t &= 2.5 \text{ sec} \\
 h(t) &= 300 \text{ ft}
 \end{aligned}$$

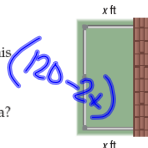
CONSTRUCTION For Exercises 48–50, use the following information.

Steve has 120 feet of fence to make a rectangular kennel for his dogs. He will use his house as one side.

48. Write an algebraic expression for the kennel's length.

49. What dimensions produce a kennel with the greatest area?

50. Find the maximum area of the kennel.



$$\begin{aligned}
 48. \quad 120 - 2x \\
 A(x) &= (120 - 2x)x \\
 A(x) &= 120x - 2x^2 \\
 a &= -2 \\
 b &= 120 \\
 V &= \frac{-120}{2(-2)} = 30 \\
 V(30, 1800) \\
 x &= 30 \text{ ft} \\
 A(x) &= 1800 \text{ ft}^2
 \end{aligned}$$

TOURISM For Exercises 51 and 52, use the following information.

A tour bus in the historic district of Savannah, Georgia, serves 300 customers a day. The charge is \$8 per person. The owner estimates that the company would lose 20 passengers a day for each \$1 fare increase.

51. What charge would give the most income for the company?

52. If the company raised their fare to this price, how much daily income should they expect to bring in?

$$\begin{aligned}
 I(x) &= (\# \text{nw cost}) (\text{nw price}) \\
 &= (300 - 20x)(8 + 1x) \\
 I(x) &= -20x^2 + 140x + 2400 \\
 V(3.5, 2645) \\
 \text{fare} &= \$11.50
 \end{aligned}$$